SANDEEP MADIREDDY

Mathematics & Computer Science Division
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SCIENTIFIC EXPERTISE

- Expertise in Bayesian and frequentist machine learning
- Bayesian approaches to uncertainty quantification.
- Performance characterization of leadership-class computing and storage systems
- High performance computing on heterogeneous parallel architectures.
- Scientific computing and numerical methods for partial differential equations.
- Continuum mechanics, nonlinear finite element techniques and material constitutive modeling.

EDUCATION

University of Cincinnati, Cincinnati, OH
Ph.D., Mechanical and Materials Engineering   Feb 2016
Utah State University, Logan, UT
M.S, Structural Engineering   May 2012
Birla Institute of Technology & **Science**, Pilani, India
B.E (Hons), Civil Engineering   May 2010

RESEARCH & PROFESSIONAL EXPERIENCE

Mathematics & Computer Science Division, Argonne National Laboratory
Postdoctoral Scientist   April 2016 to Present
- Developed a probabilistic graphical model (Bayesian network) based machine learning approach to characterize the application I/O performance variability on leadership class supercomputing systems.
- Established metrics and methods to characterize correlations between the application I/O performance and the state of the file system.
- Variability and system-state aware optimization of the parameters in the I/O software stack to develop self-aware, self-adapting I/O software for leadership-class supercomputing systems.

Procter & Gamble / UC Simulation Center
Graduate Research Assistant   June 2012 to Feb 2016
- Developed a parallel nested sampling based Bayesian framework to obtain multimodal posterior distributions of parameters and perform robust model selection.
- Used this approach to characterize the material properties of the human brain tissue as a stochastic model.
- Developed a Bayesian Gaussian process based surrogate model approach to calculate the probability of traumatic brain injury for an average person in a vehicle crash.
- The physics of the vehicle crash is modeled using Finite Element modeling approach.
- Developed a stochastic PDE constrained optimization approach to model the reheating phase in injection stretch blow molding of PET plastic bottles.

AWARDS & FELLOWSHIPS

- Argonne Training Program on Extreme-Scale Computing (ATPESC) Scholar   2016
- IBRC Travel Award   2016
- Procter&Gamble Simulation Technology award,   2015
- CEAS Modeling & Simulation Fellowship, UC Simulation Center / P&G,   2012-15
- Travel award to attend 13th US National Congress on Computational Mechanics, USACM   2015
- Travel award to attend the summer school - NPMCMC, University of Valladolid (Spain) 2015
- Dean scholarship, University of Cincinnati   2012 to 2013
- University Grant Scholarship (UGS), University of Cincinnati   2012 to 2016

PEER REVIEWED PUBLICATIONS

1. **S. Madireddy**, B. Sista, K. Vemaganti,"*A Bayesian approach to selecting hyperelastic constitutive models of soft tissue*", Computer Methods in Applied Mechanics and Engineering, 291 (2015) 102-122.

2. **S. Madireddy**, B. Sista, K. Vemaganti, "*Bayesian calibration of hyperelastic constitutive models of soft tissue*", Journal of the Mechanical Behavior of Biomedical Materials, 59 (2016) 108-127.

3. H. Shi, E. Kang, B. Alex Konomi, K. Vemaganti, and **S. Madireddy** "*Uncertainty Quantification Using the Nearest Neighbor Gaussian Process*", ICSA Book Series in Statistics, submitted, (2017)

4. **S. Madireddy**, P. Balaprakash, P. Carns, R. Latham, R. Ross, S. Snyder, and S. M. Wild, "*Analysis and Correlation of Application I/O Performance and System-Wide I/O Activity*", The 12th International Conference on Networking, Architecture, and Storage, submitted (2017)

5. **S. Madireddy**, K. Vemaganti, "*Optimal experimental design to characterize viscoelastic constitutive models using Information Geometry considerations*", Journal of Biomechanics, submitted (2017).

6. **S. Madireddy**, P. Balaprakash, P. Carns, R. Latham, R. Ross, S. Snyder, and S. M. Wild, "*Modeling application I/O performance variability: A probabilistic graphical model approach*", Mathematical Performance Modeling and Analysis Workshop,ACM Sigmetrics, submitted (2017)

7. **S. Madireddy**, K. Vemaganti, E. Kang, "*A statistical surrogate based Bayesian method for calculating brain injury criteria*", in preparation, (2017)

CONFERENCE PRESENTATIONS

1. **S. Madireddy**, P. Balaprakash, S. Wild, P. Carns, R. Ross, S. Snyder and R. Latham,"*Characterization of the relationship between application I/O time and system-wide I/O traffic on leadership-class computing systems*", Argonne Postdoctoral Research & Career Symposium, 2016.

2. **S. Madireddy**, K. Vemaganti, "*A Statistical Surrogate-Based Bayesian Approach to Calculate Brain Injury Criteria*", The 12th Annual Injury Biomechanics Symposium, 2016.

3. **S. Madireddy**, B. Sista, K. Vemaganti, "*A Bayesian Approach to Selecting Hyperelastic Constitutive Models of Soft Tissue*", 13th US National Congress on Computational Mechanics, 2015.

4. **S. Madireddy**, K. Vemaganti, "*Need for Validation in Soft Tissue Constitutive Models*", Summer Biomechanics, Bioengineering and Biotransport Conference, 2015.

5. **S. Madireddy**, B. Sista, K. Vemaganti, "*Towards Accurate Modeling & Simulation of Traumatic Brain Injury: A Holistic Bayesian Approach to Calibration and Model Selection*", Spring Research Conference on Statistics in Industry and Technology, 2015.

6. **S. Madireddy** and K. Vemaganti. "*Discontinuous Galerkin (DG) based Arlequin coupling in concurrent multiscale models*", 39th Dayton-Cincinnati Aerospace Sciences Symposium, 2014.

7. K. Vemaganti, **S. Madireddy**, B. Sista. "*Validation and Uncertainty Quantification for Macroscale Soft Tissue Constitutive Models*", SIAM Conference on Uncertainty Quantification, 2014.

INVITED TALKS

1. "*A Bayesian Approach to Model Calibration, Selection & Surrogate Modeling: Application to Traumatic Brain Injury*", ICSA Applied Statistics Symposium, 2017

2. "*A Bayesian Framework for Uncertainty Quantification in Soft Tissue Mechanics: Application to Traumatic Brain Injury*", Mechanical and Materials Engineering Department Seminar, University of Cincinnati, 2016

PROFESSIONAL ACTIVITIES

1. Reviewer for SIAM Journal on Scientific Computing.

2. Reviewer for IEEE Transactions on Cloud Computing.

3. Reviewer for Journal of Parallel and Distributed Computing.

4. Program committee member for the IEEE International Conference on High Performance Computing and Communications, 2017

PROFESSIONAL MEMBESHIPS

1. Association for Computing Machinery
2. American Statistical Association.
3. USACM Technical Thrust Area on Uncertainty Quantification and Probabilistic Analysis

MENTORING ACTIVITIES

1. Mentored a high school student to win a silver medal in the computer science category at the Afro-Academic, Cultural, Technological and Scientific Olympics (ACT-SO) as a part of Argonne/ACT-SO research program.
2. Co-advising a PhD student with Dr. Kumar Vemaganti in Mechanical & Materials engineering department at University of Cincinnati.